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High frequency Receiver Functions in the Dublin Basin: application to a potential geothermal site

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The Dublin Basin (DB) is a Carboniferous sedimentary basin located in the eastern part of Ireland, SW of Dublin. In the last years, the SW margin of the basin has been the object of interest for geothermal exploration, which led to the acquisition of two reflection seismic lines and the drilling of two $\sim$ 1.4 km deep boreholes, from which a temperature of 130° C at $\sim$4 km depth has been estimated. This deep geothermal potential of the DB is strictly related to SW basin-bounding Blackrock-Newcastle Fault (BNF) and the associated fault system. This fault runs in a NW-SE direction and separates the Carboniferous deposits that fill the basin from the Lower Paleozoic basement rocks which constitute the SW margin.

In the framework of the SIM-CRUST project, four broadband seismic stations equipped with a Guralp CMG-6TD sensor have been deployed across the southwestern margin of the basin between July and August 2013, with an inter-station distance of about 1km. This closely spaced array has been designed to cross the BNF almost perpendicular. The main aim of this work is to recover the seismic stratigraphy of the shallow crust (0-8 km depth range) and determine the geometry of the BNF, by making use of the teleseismic Receiver Function (RF) method. This technique has been classically applied in seismology to image deep Earth's structure, but recent works have shown that it can also be used to retrieve information on the shallow part of the crust, just by increasing the frequency content in the analyzed RFs with little or no modifications to the preexisting analysis codes.

We calculated a set of RFs for each station, progressively increasing the frequency from 0.5 up to 10 Hz. This is expected to dramatically increase the vertical resolution in the case of a good S/N ratio in the RFs. By stacking different RFs from a large set of epicentral distance and backazimuth incoherent signals are ruled out and true conversion are enhanced. Preliminary results show the presence of coherent signal in the first 2 seconds at high frequency ($\sim$10Hz) which we directly compared with the available well logs data in the area, to provide new piece on information on the structural setting of the basin.